

**ICAC/U.S. EPA Roundtable Meeting
Washington, DC
May 4, 2017**

Who We Are: Comprised of more than 60 member companies, the Institute of Clean Air Companies (ICAC) represents the manufacturers and suppliers of air pollution monitoring and control systems, equipment, and services for stationary sources including power plants and petrochemical facilities in the U.S. and worldwide. A current list of member companies can be found attached to this agenda.

Purpose of Meeting: The ICAC and U.S. EPA will hold a roundtable meeting to exchange information on the U.S. EPA's agenda, industrial air pollution control strategies, and available technologies for reducing and measuring emissions from stationary sources in the United States. ICAC will have in attendance technology experts and business unit leaders from member companies to participate in the dialogue with Administrator Pruitt and U.S. EPA staff.

DRAFT AGENDA

1. Introductions (5 min)
2. (Administrator Pruitt) U.S. EPA Briefing on Regulatory Agenda for Stationary Emissions and Air Quality (20 min)
3. ICAC Presentation on Emissions Control and Measurement (20 min)
 - a. Industry Overview – High Quality Jobs / Cost-Effective Emission Reductions
 - b. VOC, NOx, SO₂ Controls – Industry Solutions for Preventing Acid Rain & Urban Smog
 - c. Mercury Controls – A Cost-Effectiveness Success
 - d. Measurement and Monitoring – Continuous Advancement
 - e. GHG/CO₂ Management – The Next Technology Frontier
4. Open Discussion (30 min)
5. Adjourn

CAC Full Members

ADA-ES, Inc.

9135 S. Ridgeline Blvd. Ste 200

Highlands Ranch, CO 80129

(303) 734-1727

Fax (303) 734-0330

PRODUCTS & SERVICES:

Flue gas conditioning technology, combustion control systems, and mercury control systems, as well as consulting services on a wide array of air pollution control technology.

BABCOCK & WILCOX

13024 Ballantyne Corporate Place, Suite 700

Charlotte, NC 28277

(704) 625-4900

PRODUCTS & SERVICES: Boilers (power, renewable, industrial), environmental compliance solutions, emissions monitoring/reporting (CEMS/DAHS), cooling systems, ash handling, boiler cleaning, fuel conversions, upgrades, construction/equipment installation.

BABCOCK POWER ENVIRONMENTAL

5 Neponset Street

Worcester, MA 01615

(508) 852-7100

Fax (508) 854-3800

PRODUCTS & SERVICES: Flue Gas Desulfurization Systems (FGD) for controlling acid gases and SO₂; Oxides of nitrogen (NO_x) using Babcock power's proprietary Selective Catalytic Reduction (SCR) technology; Mercury Control for power plants and waste combustors; Environmental Field Services; Waste-to-Energy plants, including combustion systems, boilers, services and air pollution control systems.

BASF CORPORATION

2655 Rout 22 West

Union, NJ 07083

(732) 205-5000

Fax (732) 205-6146

PRODUCTS & SERVICES: catalysts for VOC, CO and NO_x abatement, halogenated VOC streams, sulfur laden VOC streams and ammonia abatement. Also, rotor concentrators, NSCR/three way catalyst and SCR technologies. Certain products are available in both ceramic and metallic monolith.

BELCO TECHNOLOGIES CORPORATION (BELCO)

9 Entin Road

Parsippany, NJ 07054

+1 (973) 884-4700

info@belcotech.com

BELCO is a DuPont company. BELCO provides robust flue and exhaust gas cleaning systems to meet clean air regulations with minimal maintenance and operational requirements. For over 40 years, the engineering and process experts at BELCO have designed, customized, built, and delivered reliable and efficient systems for particulate, SO_x and NO_x reduction, as well as control of other pollutants and mists, across a wide range of applications. BELCO specializes in wet scrubbing technology for refinery FCCUs and ships.

BLACK & VEATCH

11401 Lamar
Overland, KS 66211
(913) 458-2000
Fax (913) 458-2934

Systems: Global engineering, construction, and consulting firm specializing in infrastructure development in the fields of energy, water, and information, including SCR retrofit projects.

BURNS & MCDONNELL

9400 Ward Parkway
Kansas City, MO 64114
(816) 333-9400
Fax (816) 333-3690

PRODUCTS & SERVICES: Engineering, construction, environmental and consulting services for power generation, manufacturing, and process industry clients.

CLARIANT CORPORATION

32 Fremont Street
Needham, MA 02494
(781) 433-5900

Clariant Corporation, formerly Sud-Chemie, sells, manufactures, and develops catalyst technology for industrial exhaust gas treatment. This includes removal of VOC's, HC's and decomposition of nitrogen compounds.

CRI CATALYST COMPANY

16825 Northchase Drive, Suite 1110
Houston, TX 77060
(281) 874-2130
Fax (281) 874-2499

PRODUCTS:

Low- and high-temperature SCR catalysts; VOC control catalysts; catalytic dioxin destruction systems.

DURAG, INC.

1355 Mendota Heights Rd.
Suite 200
Mendota Heights, MN 55120
(651) 451-1710

DURR SYSTEMS, INC. - CLEAN TECHNOLOGY SYSTEMS

26801 Northwestern Highway
Southfield, MI 48033
(734) 459-6800
Fax (734) 459-5837

Systems: carbon adsorption, catalytic oxidation, odor control; thermal oxidizers, regenerative thermal oxidizers, solvent recovery, VOC concentrators

Components/supplies: control systems; ductwork; insulation/lagging

Services: design, engineering, erection, general contracting, installation, long-term operating contracts, maintenance and repair; modeling, rebuilds, upgrades and performance enhancement

EPCON INDUSTRIAL SYSTEMS, LP

P.O. Box 7060
The Woodlands, TX 77387
(936) 273-3300
Fax (936) 273-6500

PRODUCTS & SERVICES: thermal oxidizers, ovens and finishing systems

FUEL TECH, INC.

27601 Bella Vista Parkway
Warrenville, IL 60555
(630) 845-4500
Fax (630) 845-4502

Fuel Tech, Inc. provides technologies for multi-pollutant emission control and advanced combustion technologies; including optimization services, low NOx burners and Over-Fire Air systems, chemical injection programs designed to improve full flexibility and boiler efficiency, and modeling services to provide solutions for power plant systems. Products include: NOxOUT® and HERTTM SNCR systems, RRI systems, ASCRTM Advanced SCR systems, ULTRATM process used to generate on-site ammonia for SCR, sorbent injection systems to control SO2, flue gas conditioning systems, and TIFI® Targeted in Furnace Injection programs to reduce slagging, SO3 and CO2 emissions, while improving boiler performance.

Systems: NOx control including: SNCR (NOxOUT® and HERT™) , Rich Reagent Injection systems, ASCR™ Advanced SCR systems, ULTRATM process, low NOx burners, Over-Fire Air systems, flue gas conditioning systems, and sorbent injection systems for SO2 control.

Services: TIFI® Targeted In-Furnace Injection Programs to improve boiler efficiency and reduce SO3 emissions. CFD & physical modeling, coal flow testing, air flow testing, CATLife®SCR catalyst management services.

HALDOR TOPSOE

17629 El Camino Real
Suite 300
Houston, TX 77058
(281) 228-5000
Fax (281) 228-5109

PRODUCTS & SERVICES:
Catalysts

HITACHI ZOSEN INOVA

3740 Davinci Court, Suite 250
Norcross, GA 30092
(678) 987-2500
Fax: (678) 987-2599

JOHNSON MATTHEY STATIONARY SOURCE EMISSIONS CONTROL

456 Devon Park Drive
Wayne, PA 19087
(610) 341-8300
Fax (610) 341-8258

Systems: SCR systems for engine industries and regenerative oxidation catalyst systems for process industries.

Components/supplies: SCR catalyst, catalyst housing, catalyst elements, pelleted catalyst for printing, chlorinated catalyst

LHOIST NORTH AMERICA

3700 Hulen Street
Ft. Worth, TX 76107
(817) 732-8164
Fax (817) 732-8564

PRODUCTS & SERVICES:

Supplies calcium products for emission control applications, including MAG-ON-Demand Reagent for Wet Lime Scrubbers and Sorbacz sp- A hydrated lime product optimized for dry injection acid gas control applications.

MET - MARSULEX ENVIRONMENTAL TECHNOLOGIES

200 North Seventh Street
Lebanon, PA 17046-5006
(717) 274-7000
Fax (717) 274-7085

PRODUCTS & SERVICES: Wet and dry FGD; particulate, NOx, and ash technologies.

MITSUBISHI HEAVY INDUSTRIES AMERICA

20 East Greenway Plaza, Suite 830
Houston, TX 77046
(346) 308-8800

PRODUCTS & SERVICES: KM CDR Process, amine based post-combustion CO2 capture technology.

MITSUBISHI HITACHI POWER SYSTEMS AMERICAS - ENERGY AND ENVIRONMENT, LTD.

645 Martinsville Road
Basking Ridge, NJ 7920
(908) 605-2799

NALCO AIR PROTECTION TECHNOLOGIES

1601 West Diehl Road
Naperville, IL 60563
(630) 305-1000
Fax (630) 305-2900

PRODUCTS & SERVICES: Nalco Company is the world's leading water treatment and process improvement services company, delivering significant environmental, social and economic performance benefits to a variety of industrial and institutional customers.

PRAXAIR, INC.

39 Old Ridgebury Road
Danbury, CT 06810
(1-800- PRAIXAIR)
Fax (1-800-772-9985)

SERVICES & PRODUCTS:

Praxair is a global, Fortune 500 company that supplies atmospheric, process and specialty gases, high performance coatings and related services and technologies.

SICK, INC.

6300 Old Shakopee Road
Suite 124
Minneapolis, MN 55438
(763) 201-9200
Fax (763) 201-9210

PRODUCTS & SERVICES: SICK Maihak offers in-situ and extractive analyzers for gas and liquid analysis and measurement instrumentation for dust, opacity, volume flow and level, and offers a mercury analyzer and CEMS.

SPECTRUM SYSTEMS, INC.

3410 West Nine Mile Road
Pensacola, FL 32526
(850) 944-3392
Fax (850) 944-1011

PRODUCTS & SERVICES: Continuous emissions monitoring services, including maintenance, data acquisition and reporting, testing, parts, studies, training, and system manufacturing.

THERMO FISHER SCIENTIFIC CORPORATION

27 Forge Pkwy
Franklin, MA 02038
(508) 553- 1176
PRODUCTS & SERVICES: Emissions measurement and monitoring.

UNITED CONVEYOR CORPORATION

2100 Norman Dr
Waukegan, IL 60085
(847) 473- 5900

PRODUCTS & SERVICES: United Conveyor Corporation (UCC) is a global leader in ash handling, dry sorbent injection and multi-pollutant solutions for the power generation industry. Since 1920, UCC has been committed to the design, supply, construction, and maintenance of world class conveyor systems precisely engineered to better serve utility providers. UCC owns and operates a steel fabrication facility to maintain direct control over quality and timely delivery of manufactured components and replacement parts guaranteed to meet or exceed stringent customer performance requirements. The company offers a global network of sales and service representatives serving customers and installations spanning six continents.

WUNDERLICH-MALEC

6101 Blue Circle Drive
Eden Prairie, MN 55343
(952) -933-3222

PRODUCTS & SERVICES

Large engineering company based in the U.S., serving a variety of markets and services. Wunderlich Malec's interest in air pollution control includes: CEMS, PEMS, Ambient, CPMS and DAHS.

ICAC Associate Members

ADA CARBON SOLUTIONS, LLC

1460 W. Canal Ct.
Suite 100
Littleton, CO 80120
(303) 926-1977
Fax (303) 9261970

PRODUCTS & SERVICES:

ADA Carbon Solutions provides activated carbon products specifically tailored for mercury capture from flue gas streams. Our expertise in mercury control and our state of the art assets help our clients achieve cost effective, reliable compliance.

AECOM

510 Carnegie Center
Princeton, NJ 08540
(609) 720-2000

ALBEMARLE PERFORMANCE CHEMICALS

451 Florida Street
Baton Rouge, LA 70801
(225)-388-7402
Fax (225)388-7686

PRODUCTS & SERVICES:

Albemarle Performance Chemicals provides specialty chemicals to a wide range of industry segments, including the recent acquisition of Sorbent Technologies Corporation which produces activated carbon reagent used in mercury removal systems.

ATLAS CARBON

1615 Poydras Street, Suite 1280
New Orleans, LA 70112
(307) 685-7214

PRODUCTS & SERVICES: Premium Activated Carbon Products for Advanced Mercury Control. Located in the heart of the Powder River Basin in Gillette Wyoming, Atlas Carbon uses high-quality, abundant PRB coals in combination with their patented Pneumatic Flash Calciner (PFC) activation process to produce cost-effective activated carbon solutions.

CALGON CARBON CORPORATION

P.O. BOX 717
Pittsburgh, PA 15230
(412) 787-6700
Fax (412) 787-6676

PRODUCTS & SERVICES:

Calgon manufactures granular activated carbon and the primary products for the air pollution control industry offered by Calgon carbon are powdered activated carbons for control of mercury emissions from coal-fueled power plants. Calgon offers standard activated carbon powder, brominated carbon, and cement-friendly powdered activated carbon.

CALIFORNIA ANALYTICAL INSTRUMENTS, INC.

1238 West Grove Avenue
Orange, CA 92865
(714) 974-5560
Fax (714) 921-2531

Systems: gas analyzers (CO, CO₂, NO, NO_x, O₂, SO₂, THC, TNMOC, VOCs); complete line of monitoring and sensing equipment

CARBONXT, INC.

3951 NW 48th Ter, Suite 111
Gainesville, FL 32606

PRODUCTS & SERVICES: Carbonxt offers engineered powdered activated carbons for mercury capture with the aim to continually improve capture efficiency thus continuously lowering sorbent costs. Carbonxt's activated carbons offer increased compliance flexibility as they are non-halogenated (avoids air-heater corrosion), are customized to individual boiler environments, and have been successfully demonstrated to achieve MATS compliance for all coal types and particulate collection devices. Carbonxt is eager to deliver unparalleled service including inventory management, just in time delivery, and comprehensive engineering.

CONCORD MANAGEMENT SERVICES

520 S. Burnt Mill Rd.
Voorhees, NJ 08043
(856) 427-0200

PRODUCTS & SERVICES: CMS' Environmental Controls Division focuses on helping energy producers maximize plant performance and compliance through independent, innovative, experience-based engineering of CO and SCR catalyst and systems for natural gas and coal-fired utilities, as well as a smaller-scale reciprocating engine generator plants

CORNING INCORPORATED

Environmental Products Division
HP-CB-02-1
Corning, NY 14831

(607) 974-9000

Fax (607) 974-4617

PRODUCTS & SERVICES:

Environmental Products Division supplies ceramic supports, woodstove combustors and hydrocarbon traps of various sizes and cell densities for VOC, NOx, particulate, and diesel applications.

ENERFAB

4955 Spring Grove Ave.

Cincinnati, OH 45232

(513) 641-0500

PRODUCTS & SERVICES: SCRs, Baghouses, PJFF, Scrubbers, ACI, DSI, Trona Injection, and Precipitator rebuilds.

FIB INDUSTRIAL

Einsteinweg 18

8912AP - Leeuwarden

Netherlands

+31-(0)58-2-945-945

PRODUCTS & SERVICES

Designs and fabricates pressure and process containing equipment, serving the petro chemical, oil and gas, power generation and food processing industries.

GREAT LAKES SOLUTIONS, A CHEMTURA BUSINESS

1801 US Highway 52 W

West Lafayette, IN 47906

(765) 497-6011

HUG CONSULTING LLC

1686 Nickerson Way

Arnold, MD 21012

(443) 223-2419

SERVICES: Providing strategic management and organizational development consulting to energy and environmental technology firms. Additionally, provide air emission/environmental compliance assessments for owner/operators of power generation and heavy industrial facilities.

ICL - Industrial Products

16800 Imperial Drive, Suite 310

Houston, TX 77060

PRODUCTS & SERVICES: ICL-IP is the world's largest producer of bromine and brominated derivatives, including calcium bromide. ICL-IP develops, produces, and markets specialty products serving a wide range of industrial applications. Headquartered in Beer-Sheva, Israel, ICL-IP manages the world's largest bromine production supply chain. With subsidiaries, production sites and business partners throughout the world, ICL-IP manages a sales, marketing and technical support global network dedicated to servicing its markets with the highest safety and environmental standards.

KOCH KNIGHT LLC

PO Box 30070

5385 Orchard View Dr. SE

East Canton, OH 44730

(330) 488-1651

Fax 330-488-1656

PRODUCTS AND SERVICES: Koch Knight LLC provides corrosion solutions and heat exchange media serving various industries including the refining and petrochemical industries. Product offerings include heat transfer media for regenerative thermal oxidizers (RTOs) and other types of thermal oxidation systems, random and structured packing materials (ceramics, plastics, monolith honeycomb, etc.),

ceramic and graphite tower internals, sumps, brick linings, mortars, acid-proof membranes, and overall design, installation, and service capabilities in corrosion systems.

KRISHNAN & ASSOCIATES

250 Post Road East
Suite 110, The Professional Building
Westport, CT 06880
(203) 226-3120
Fax (203) 854-2758

SERVICES:

Full service technical consulting firm that provides marketing, market analysis, executive recruitment and M&A services to the power industry including equipment suppliers, GENCOs, CFD modeling companies, A&E firms, and other service providers to the power industry worldwide.

LINDE ELECTRONICS & SPECIALTY GASES

LOGICAL CLEAN AIR SOLUTIONS

3625 E Thousand Oaks Blvd, Suite 261
Westlake Village, CA 91362
(888) 310-4192
Fax: (805) 230-0099

PRODUCTS & SERVICES: Logical Clean Air Solutions aims to help global vehicle and equipment manufacturers fulfill their needs for ceramic components and catalysts for emission control systems. With over 10 years of successful partnerships with leading manufacturers of ceramic substrates, diesel particulate filters, and emission control catalysts, we work closely with our customers to achieve cost-effective solutions. From regulatory compliance, design and development services, to samples manufacturing and full scale production, Logical is your one stop for all emission control components and service needs.

MC-INDUSTRIAL

3117 Big Bend Blvd.
St. Louis, MO 63143
(314) 646-4100
Fax (314) 646-4101

PRODUCTS & SERVICES:

MC Industrial provides construction services for the installation of pollution control equipment. As a general contractor, MC Industrial performs civil, structural, mechanical, and boilermaker related work, and subcontract piping and electrical installations.

METALTEK

905 E. St. Paul Avenue
Waukesha, WI 53188
(262) 544-7777

PRODUCTS & SERVICES: Centrifuge bowls, Diffusers, Fittings, Impellers, Mixer blades, Nozzles, Oil / Water separator components, Rotors, Third stage separators, Valves

MISSISSIPPI LIME COMPANY

3870 S. Lindbergh BLvd. Suite 200
St. Louis, MO 63127
(314) 543-6300
Fax (314) 543-6573

PRODUCTS & SERVICES:

Reagent Technology Services, a division of Mississippi Lime Company provides lime and limestone reagents for utility and industrial source flue gas desulfurization. Chemicals targeted for control include SO₂, SO₃, Mercury, Arsenic and HCl.

MKS INSTRUMENTS, INC.

90 Industrial Way
Wilmington, MA 01887
(978) 284-4000
Fax 978-284-4999

PRODUCTS & SERVICES:

Provides process control solutions for advanced manufacturing processes such as semiconductor device manufacturing; thin-film manufacturing for flat panel displays, optical storage media, architectural glass and electro-optical products; and technology for medical imaging equipment. The instruments group provides instruments, components, subsystems and services for pressure and flow measurement and process control, leak detection, calibration, gas analysis (mass spec, NDIR, FDIR), and control and information technologies.

PAGET EQUIPMENT CO.

417 E. 29th St.
PO Box 369
Marshfield, WI 54449
(715) 384-3158

PRODUCTS & SERVICES: Paget Equipment Co. is a general fabricator to industrial companies so is in the equipment fabrication business. Their business processes focus on adding long-term value and enhanced competitiveness for their customers.

PERMA PURE

1001 New Hampshire Ave.
Lakewood, NJ 08701
(732) 244-0010

PRODUCTS & SERVICES: designs and manufactures gas conditioning products including dryers, humidifiers, filters, coalescers, specialty scrubbers and complete sampling systems for use in critical applications such as process control, CEMS, and ambient air monitoring.

SERVOMEX

4 Constitution Way
Woburn, MA 01801-1087
(781) 935-4600

PRODUCTS & SERVICES

Stable gas measurement solutions for combustion control, process control, emissions monitoring, safety monitoring, and quality assurance.

SOLVAY CHEMICALS, INC.

3333 Richmond Avenue
Houston, TX 77098-3099
(713) 525-6800
Fax (732) 525-7804

PRODUCTS & SERVICES:

Variety of sodium-based products, including sodium sesquicarbonate (natural trona), which is used in acid gas scrubbers.

STRUCTURAL STEEL SERVICES, INC.

P.O. Box 2929
Meridian, MS 39302
(601) 483-5381
Fax (601) 483-8742

PRODUCTS & SERVICES:

Structural steel fabrication for air pollution control equipment and systems

W.L. GORE & ASSOCIATES, INC

101 Lewisville Rd.

Elkton, MD 21921

(410) 506- 3413

PRODUCTS & SERVICES: Gore Mercury Control System featuring fixed sorbent for mercury capture and SO2 removal as a co-benefit; baghouse filter bags and hardware including cages, venturis, pulse valves, bag caps, control panels, tube sheets and pulse pipes.

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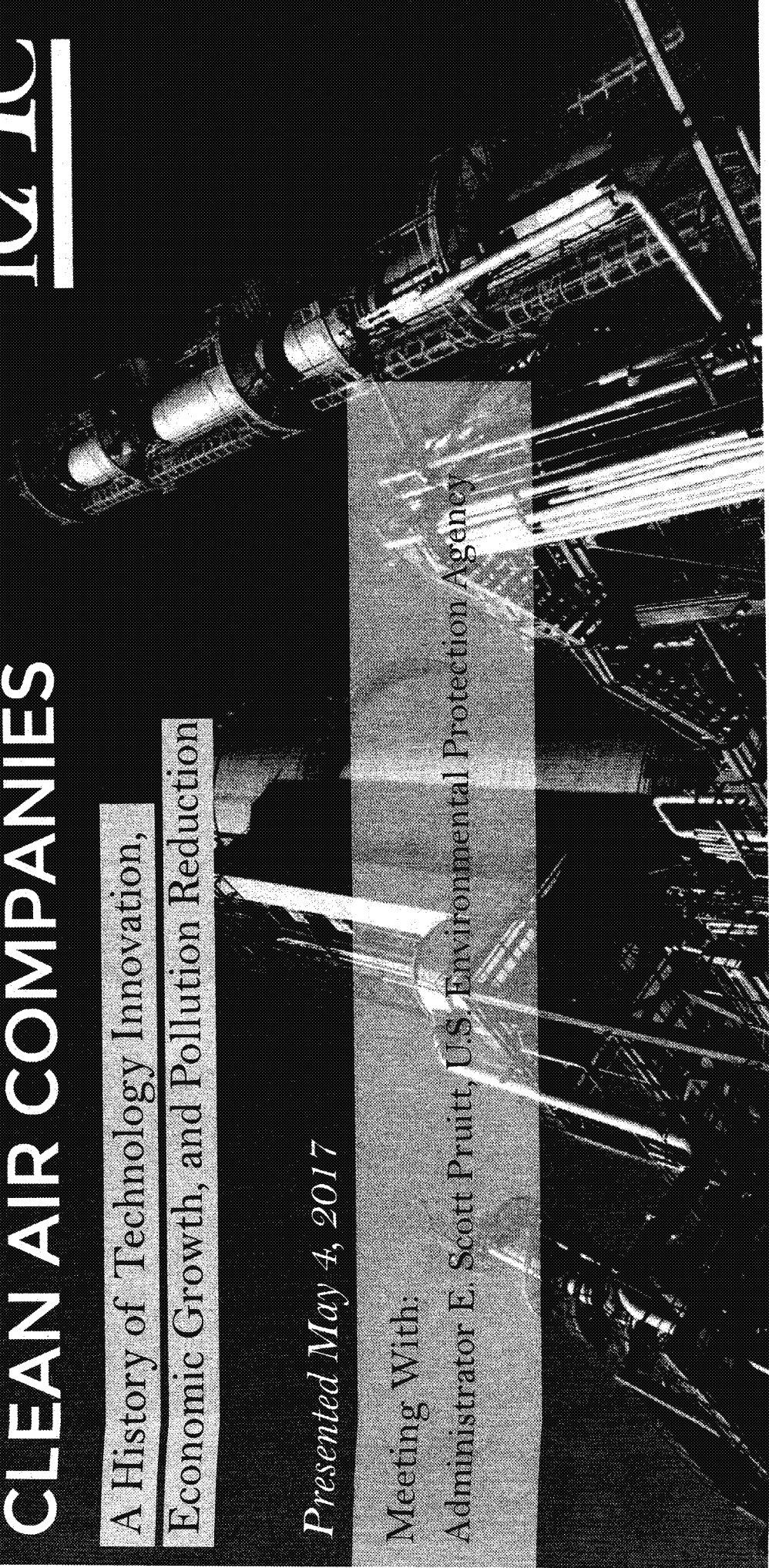
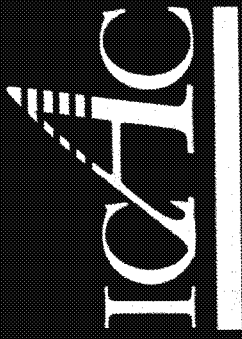
THE INSTITUTE OF CLEAN AIR COMPANIES

A History of Technology Innovation,
Economic Growth, and Pollution Reduction

Presented May 4, 2017

Meeting With:

Administrator E. Scott Pruitt, U.S. Environmental Protection Agency





ABOUT

Since the 1960s, the Institute of Clean Air Companies (ICAC), comprised of more than 60 member companies, has represented suppliers of air pollution monitoring and control systems, equipment, and services for stationary sources in the U.S. and Canada.

Public
Health

Environmental
Quality

Industrial
Progress

MEMBERS



HALDOR TOPSOE 
CATALYSING YOUR BUSINESS

**Hitachi Zosen
INOVA**


**ICL Industrial
PRODUCTS**


Johnson Matthey
Catalysts


 **Lhoist North America**
Lhoist Group

MET 
Marsulex Environmental Technologies

 **MITSUBISHI**
HEAVY INDUSTRIES, LTD.

atlas 
CARBON

 **MITSUBISHI HITACHI
POWER SYSTEMS**

 **NALCO**
An Ecolab Company

 **PERMA PURE**

SERVOMEX 

 **SOLVAY**
asking more from chemistry® | **Chemicals**

ThermoFisher
SCIENTIFIC

 **Wunderlich-Malec**
Engineering | Systems | Services

Technology Is The Enabler



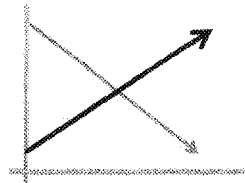
ICAC members see *technology as an enabler* to achieve cleaner air with minimal disruption to the processes being controlled.

Since the enactment of the CAAA's, ICAC member companies have been behind the design and deployment of technologies that make improvements in air quality possible.

TECHNOLOGY: where advancements in health, environmental protection & economic growth intersect



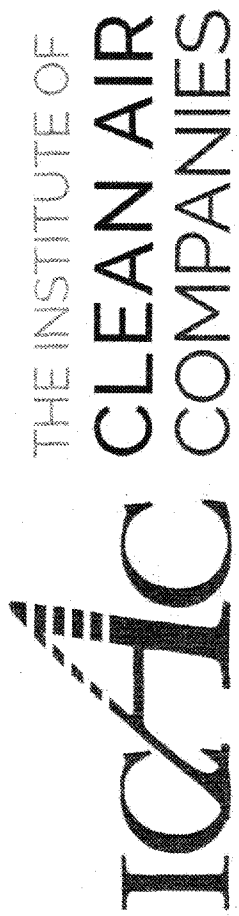
**Creates
Quality Jobs**



**Grows the Economy,
Reduces Pollution**



**Global Technology
Exports**



Background



WHAT WE DO

MISSION

- To be *the* independent expert voice of the stationary source air pollution control and monitoring industry
- Provide a forum for experts to come to a common understanding of industry challenges and opportunities.
- Leverage the collective knowledge and project experience to advance technology

VISION

- To achieve a balance between air quality and industrial growth by providing credible high quality technical information

VALUES

- Encourage policies that are achievable and cost-effective with technology innovation
- Treat all stakeholders equally and with respect

Delivering Clean Air

ICAC always works in cooperation with industry; federal, regional, and state governments; and other stakeholders to demonstrate and deploy technology.

Industry

- Electric Power Research Institute (EPRI)
- Edison Electric Institute (EEI)
- Coal Utilization Research Council

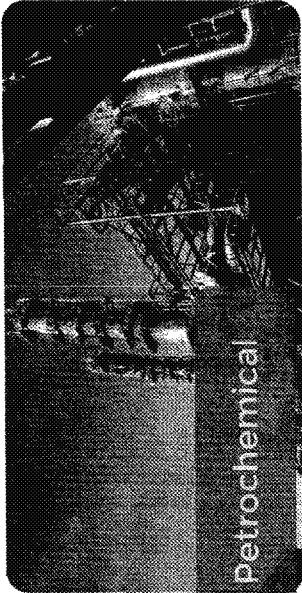
Government

- Environmental Protection Agency
- Department of Energy
- State, Local, And Regional Governments

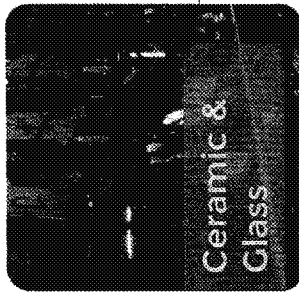
ICAC CUSTOMERS



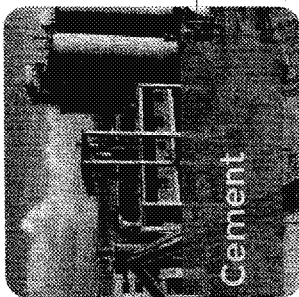
Gas Turbines



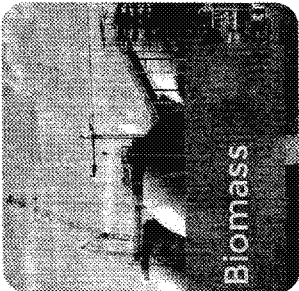
Petrochemical



Ceramic &
Glass



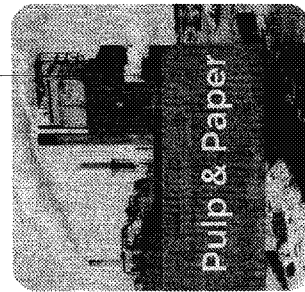
Cement



Biomass



Waste-to-
Energy



Pulp & Paper



Coal-Fired Boilers



Metal

Our Successes:

Utility & Industrial Emissions Dramatically Decline

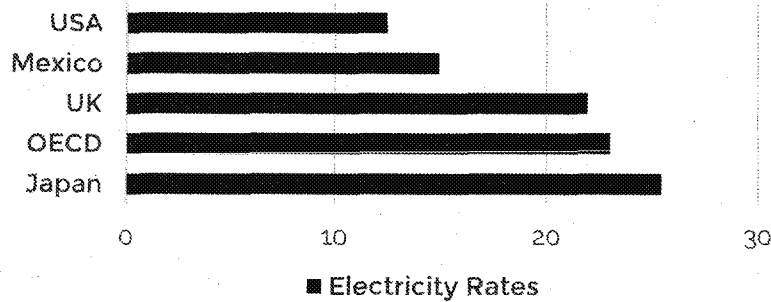
ICAC Members' technology innovations have enabled:

- *More* energy production
- *More* economic productivity

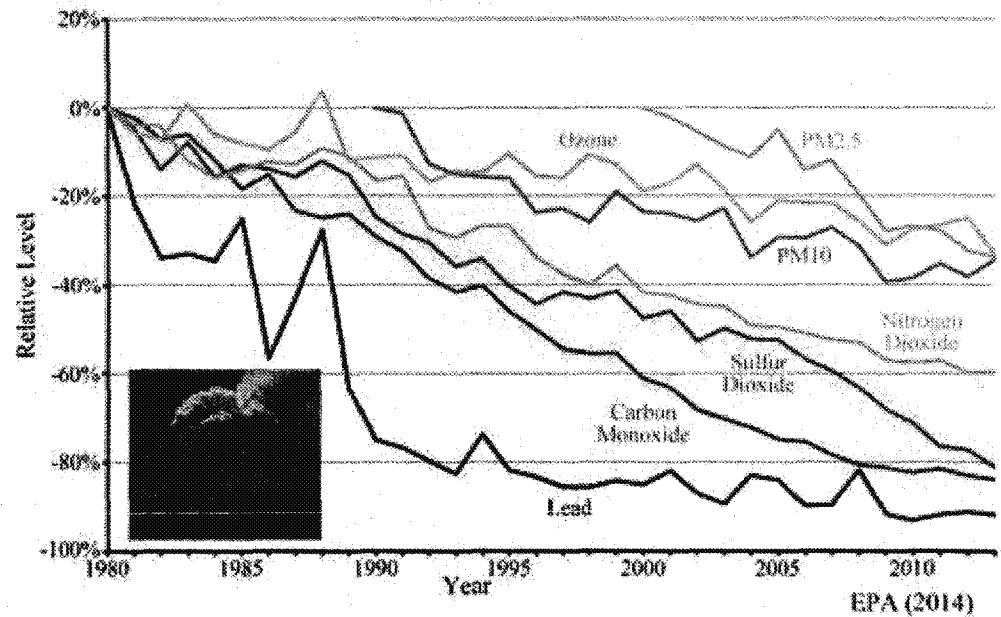
Together With:

- *Dramatically* cleaner air

Electricity Rates



US Air Pollution 1980-2013



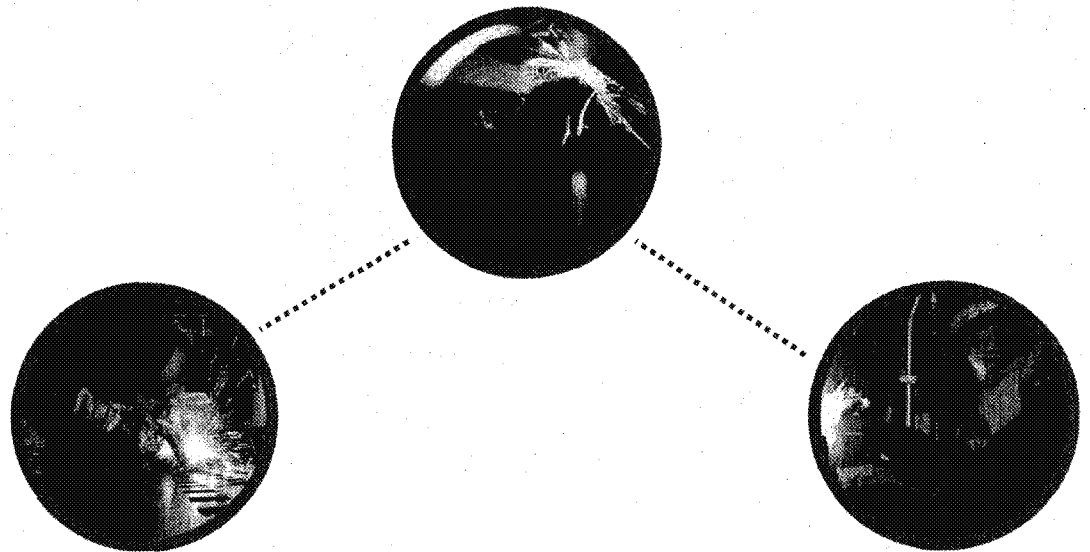
A JOB-CREATING INDUSTRY

Environmental Standards Drive
Job Creation:

The Clean Air Interstate
Rule Phase 1 resulted in:

200,000 Jobs

person-years of jobs over 7 years



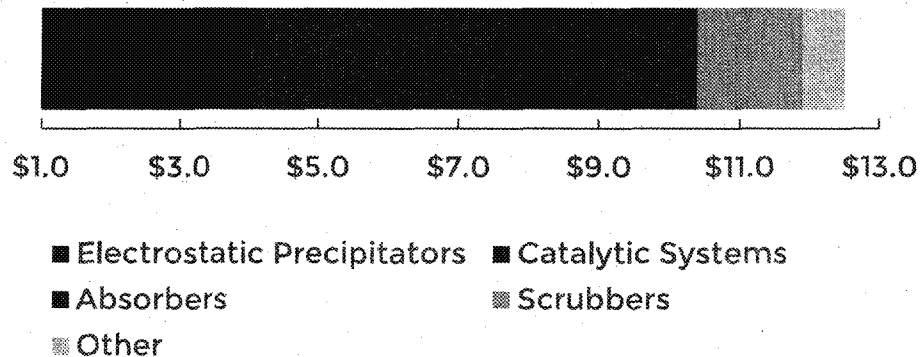
Direct and Indirect
Labor includes:

Engineers; project managers; boilermakers; steel workers; fabricators; concrete makers; manufacturing of slurry pumps, fans, motors and catalysts; processing of reagents for pollution controls, such as hydrated lime, sodium bicarbonate, and activated carbon.

Strong U.S. and Global Markets

\$12.5 Billion

U.S. Industrial Emission
Control Market Size
2015



Note: Figures are all in USD and estimates for 2015

Source: http://www.trade.gov/topmarkets/pdf/Environmental_Technologies_Executive_Summary.pdf

\$1.05 Trillion

Global Environmental
Technologies Goods and
Services Market Size 2015

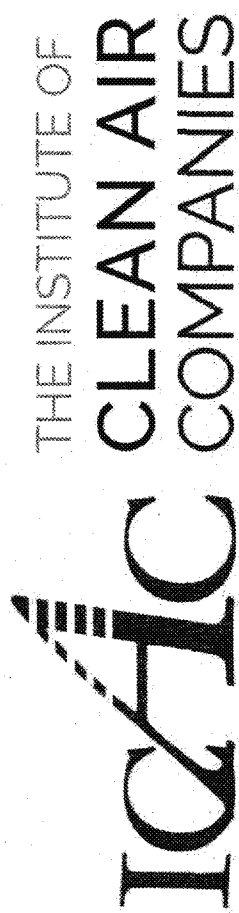


\$303.0 billion

U.S. environmental
technologies market size

\$51.2 billion

Value of exports from U.S.
environmental companies



Decades Of Success

Actual Costs Often Far Below Initial Estimates

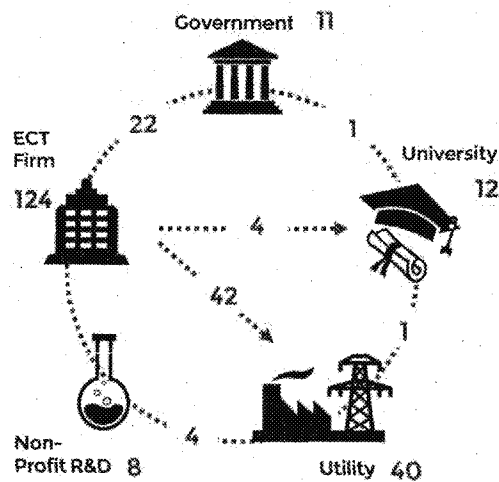
- Sulfur Dioxide / Acid Rain
- Mercury / MATS

Innovation Leads to Economic Activity

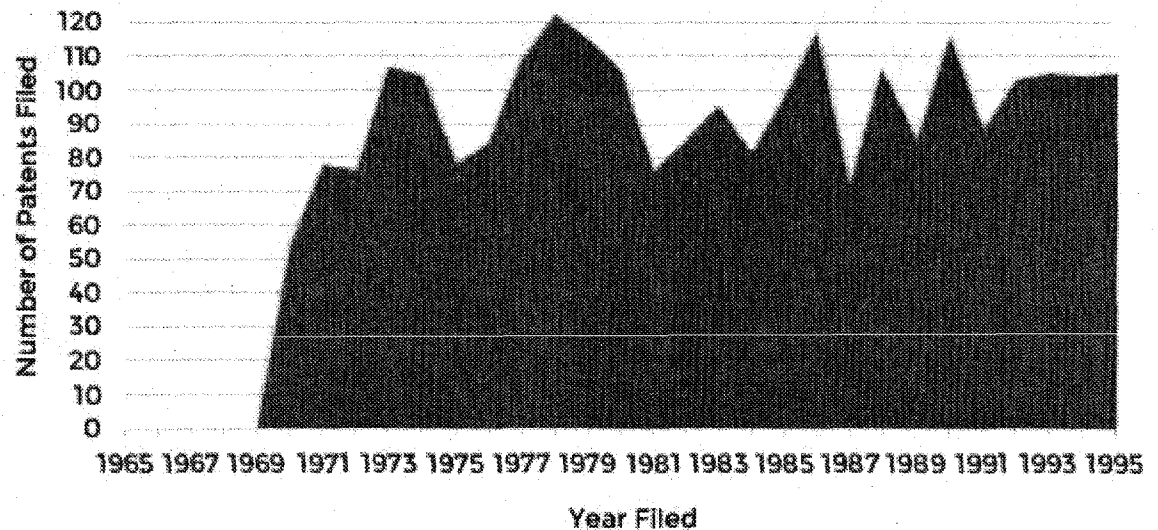
Government Action Has Spurred Innovation In SO₂ Control Technology.

Cost-effective policies have stimulated research collaboration between institutions, which has led to technological development (evident in the growth of patents filed).

Co-Authorships between Institutions



U.S. Patents Filed



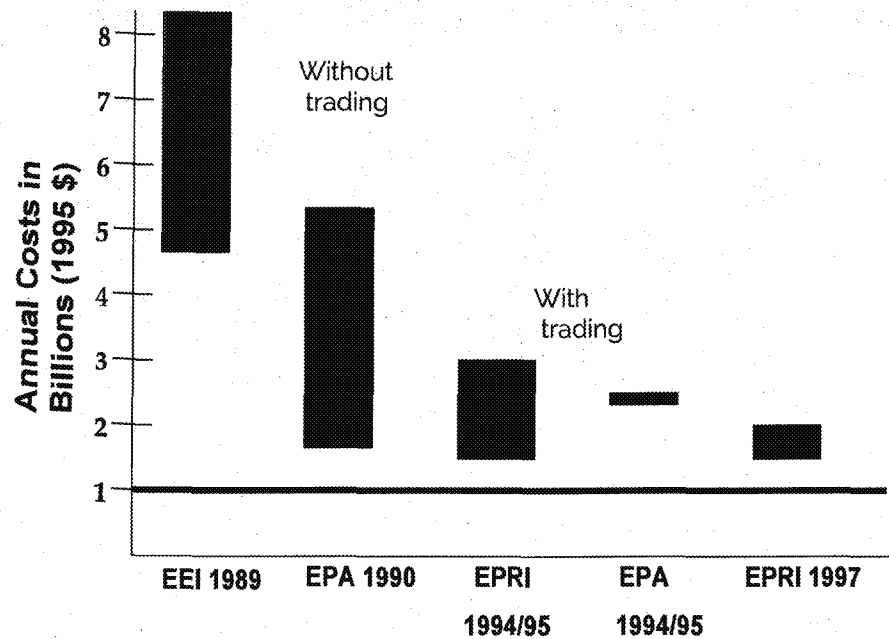
Sources:

https://www.researchgate.net/figure/9030073_fig5_Figure-7-Evolving-coauthorship-ties-between-organization-types-for-three-time-periods

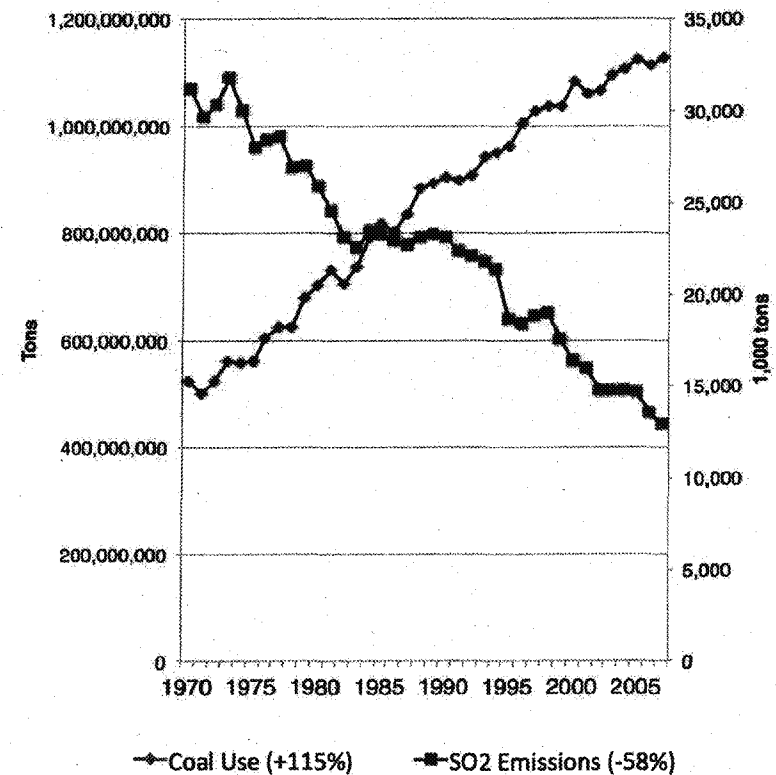
https://www.google.com/search?q=so2+control+technologies&source=lnms&tbn=isch&sa=X&ved=0ahUKEwiZz62y8TTAhVVELYKHKVsBnsQ_AUICygC&biw=1366&bih=662#imgrc=WL-V3NXl42n67M

Costs of Emissions Control Decrease Over Time with Increased Experience and Improvements

Example: Phase II Federal Acid Rain Program



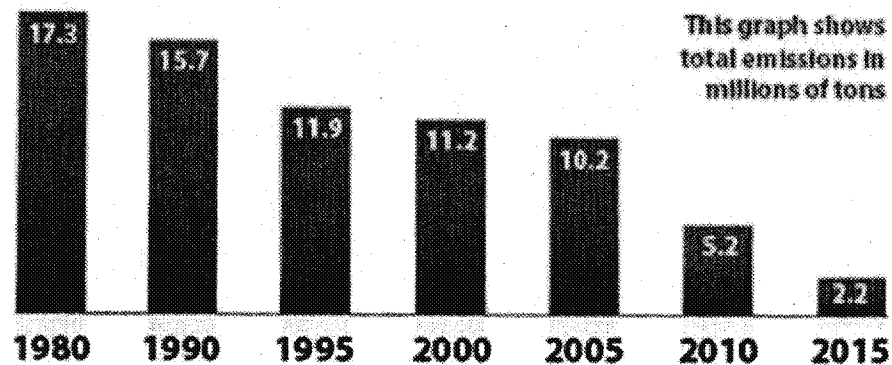
Coal Use vs. SO2 Emissions



Source: <http://www.powerlineblog.com/archives/2015/04/a-note-on-coal.php>

Success of American Ingenuity

Declining Annual SO₂ Emissions

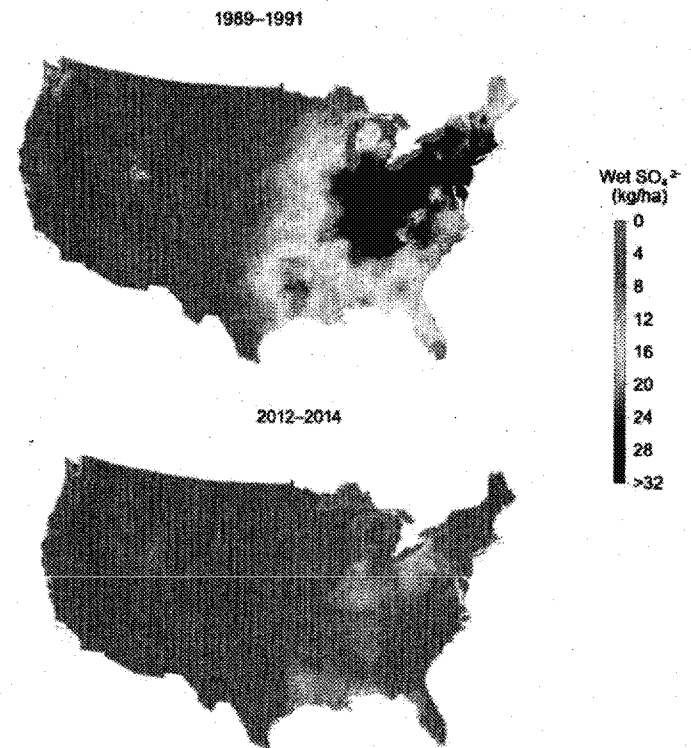


Factors Contributing to Success

- Smart, market-based environmental regulations
- Modernization of rail transport
- Emission control technology innovation

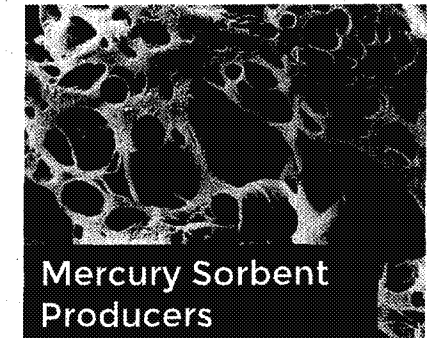
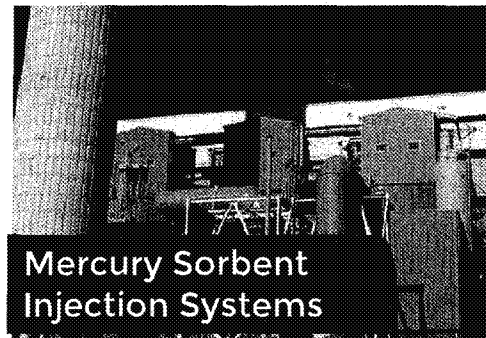
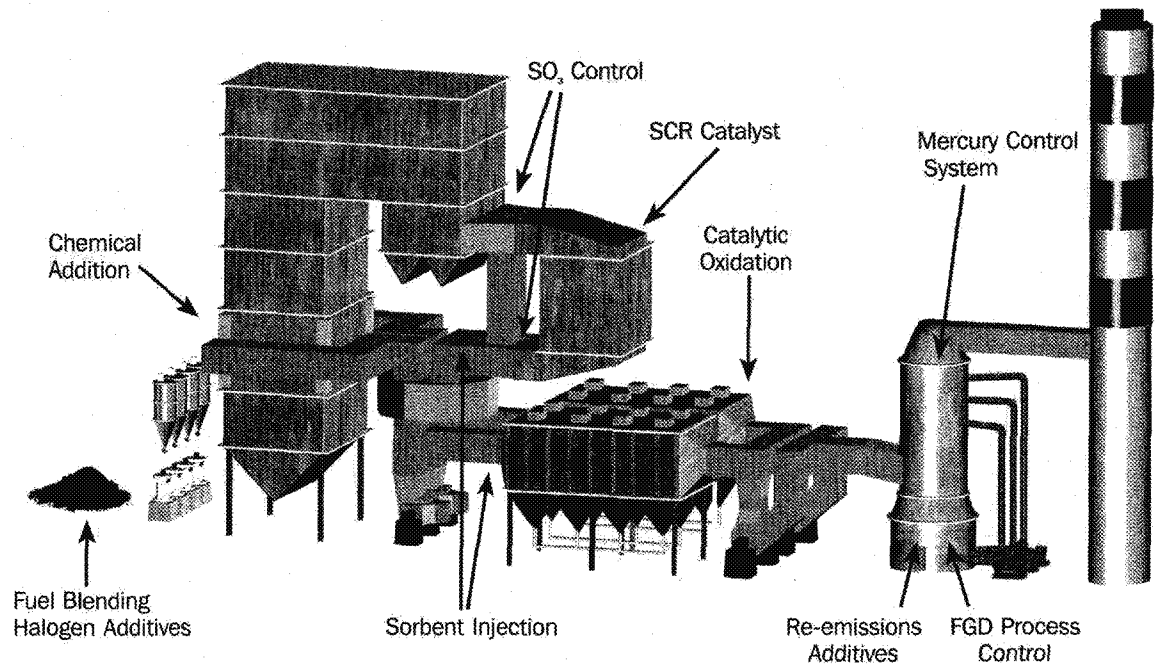
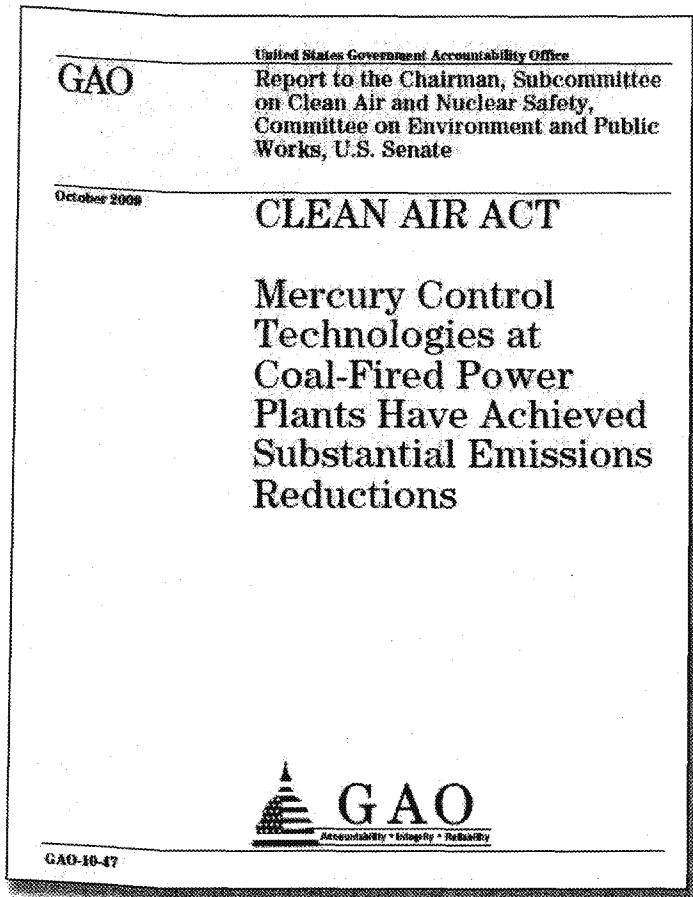
Significant Declines in Wet SO₂

Three-Year Wet Sulfate Disposition



Source: EPA, 2016
Last updated: 05/2016

Mercury Control Options from Coal to Stack



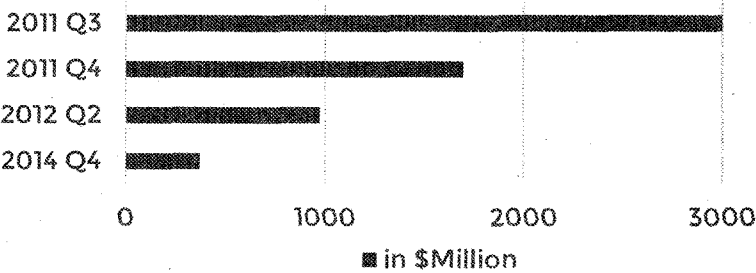
Collaboration & Innovation Drove Actual Costs Down ~90%

COAL-FIRED MERCURY CONTROL

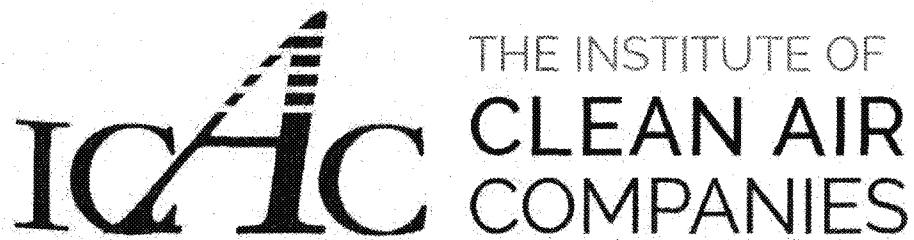
studied by EPRI, EPA, DOE and others since 1990

1990s	Early 2000s	Today	Ongoing Development
<ul style="list-style-type: none">• Multiple-pollutant control laboratory & pilot-scale studies• Major issues with Hg measurement at low levels	<ul style="list-style-type: none">• Introduction of halogen-treated activated carbons• Measurement improvements & options expanded	<ul style="list-style-type: none">• Identification of critical aspects of carbon that drive performance in mercury capture• Measurements still challenging and high-maintenance	<ul style="list-style-type: none">• Solutions tailored for specific circumstances to achieve optimal compliance solutions

Industry Cost Estimates for MATS Compliance (in \$ Million)



Mercury control has been used on commercial coal fired power plants since 2007



Our Technologies

Substantial APC Advancements:

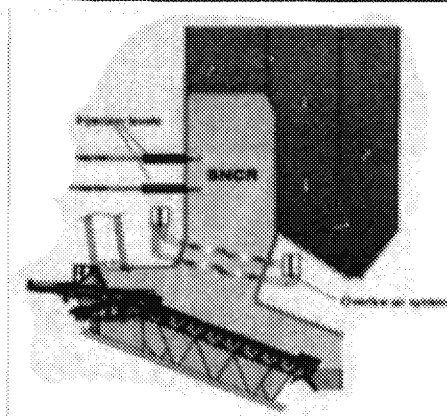
ICAC Members Pollution Control Technologies, Goods and Services

Mercury Controls	Hg removal demonstrated at 90%+
NOx Controls	NOx removal of 95%+
VOC Controls	VOC typical destruction of 98%+ for a wide range of applications
Particulate, SO2, HCL Controls	PM removal of >95% with wide range of technologies <ul style="list-style-type: none">• SO2 removal of 90+% with DSI, 95%+ with WESP• Acid gas control using Dry Sorbent Injection of Alkaline Sorbents<ul style="list-style-type: none">• HCl >90% control• SO3 > 95% control
Carbon Monoxide Controls	Carbon Monoxide Controls CO control up to 99% DRE (>1,000 power plants and industrial boilers)
Consumable Products	Consumable Products Reagents, Sorbents, Hydrated Lime, Sodium Bicarbonate, Activated Carbon, Trona, Ammonia, Ammonium Sulfate, Urea
Emissions Measurement & Monitoring	
Engineering, Consulting, System Services	

OUR TECHNOLOGY

NOx & CO Controls

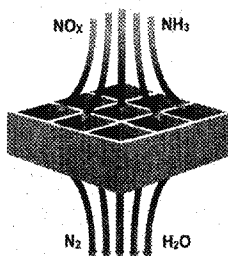
Selective Non-Catalytic Reduction (SNCR) 15-35% reduction



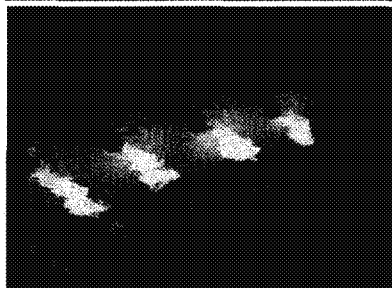
For Sources of Combustion:

- Boilers, Turbines, Engines, Process Heat, Iron and Steel, Lime Kilns, Glass, Cement, etc.

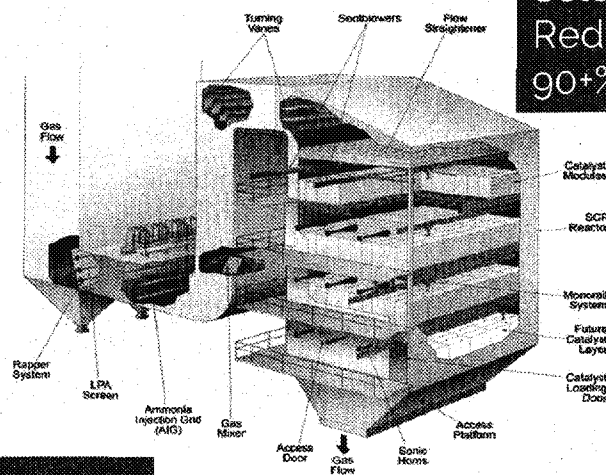
Catalysts



Low-NO_x Burners / Over-Fired Air (OFA) 40-60% reduction



Selective Catalytic Reduction (SCR) 90+% reduction



CO Control:
Catalytic Reduction



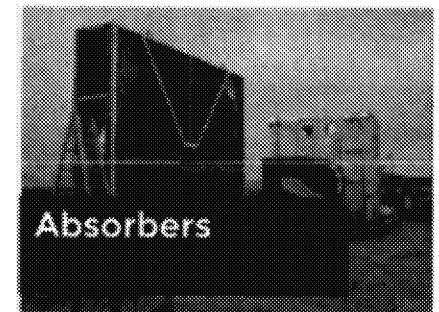
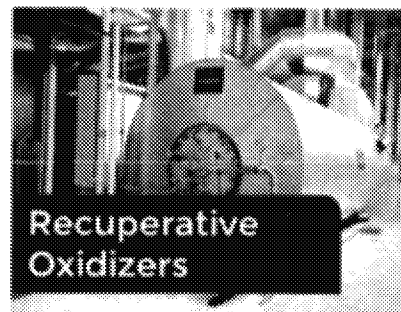
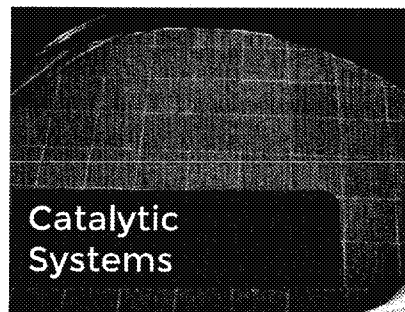
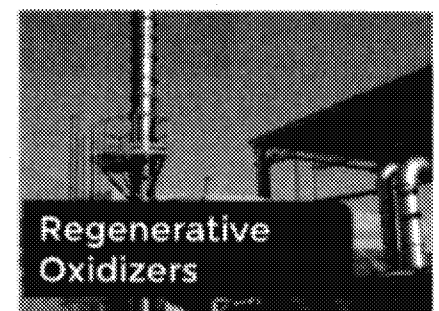
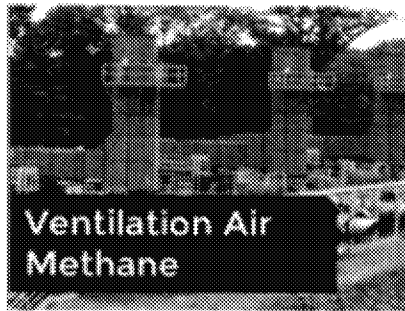
OUR TECHNOLOGY

VOC Controls

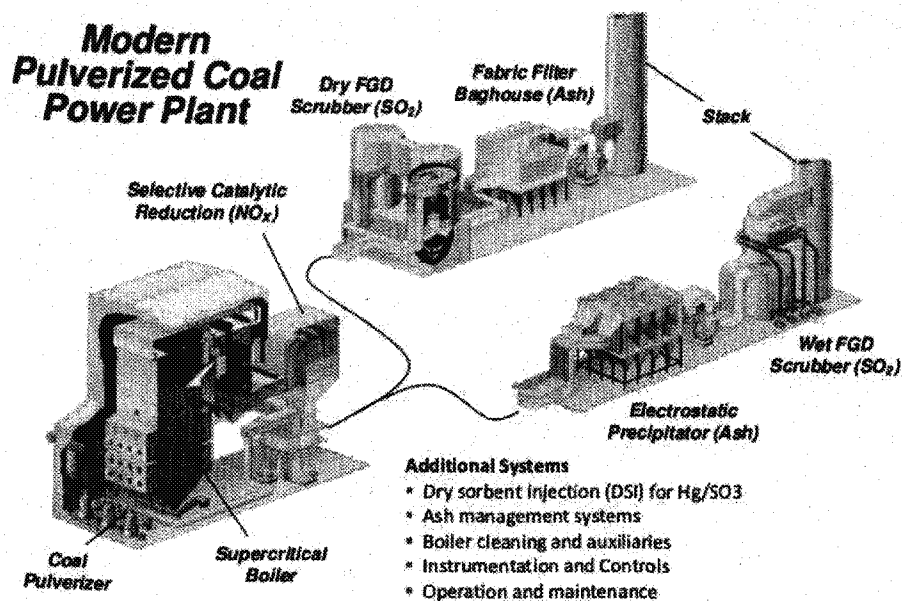
VOC controls are deployed over a wide range of industries, capable of up to 99% destruction.

DEPLOYED IN:

- Petrochemical
- Chemical
- Pharmaceutical
- Wood Products
- Painting
- Coating
- Electronics
- Oil & Gas



SO₂, Acid Gas and Particulate Controls



SO₂ Controls Are Needed At:

Industrial, Commercial and Institutional Boilers | Cement Kilns | Petroleum Refineries | Glassmaking facilities | Asphalt | Chemicals | Coke manufacturing Lime Kilns | Brickmaking facilities | Pulp and Paper | Ferrous Metals | Petroleum Coke Calciners

WET SCRUBBER High Capital Cost, reagent required, also captures Hg, PM, HCL

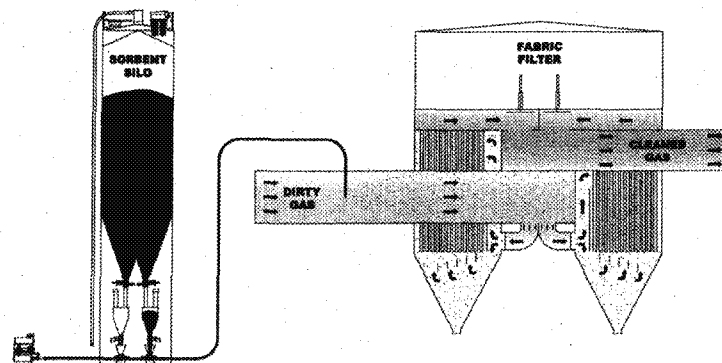
DRY SCRUBBER (WITH FABRIC FILTER) High Capital cost, Reagent Required, also captures Hg, PM and HCL at high levels

DRY SORBENT INJECTION Low Capital Cost, Requires Reagent, Co-benefits: Hg, NO_x, HCL

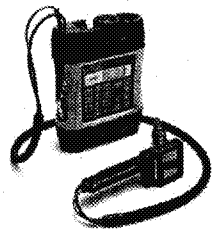
ELECTROSTATIC PRECIPITATOR Provides PM control, often in connection with a wet scrubber.

DSI/ACI with Fabric Filter

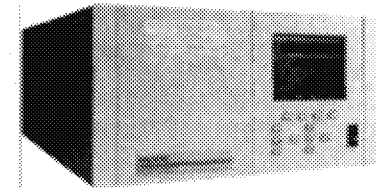
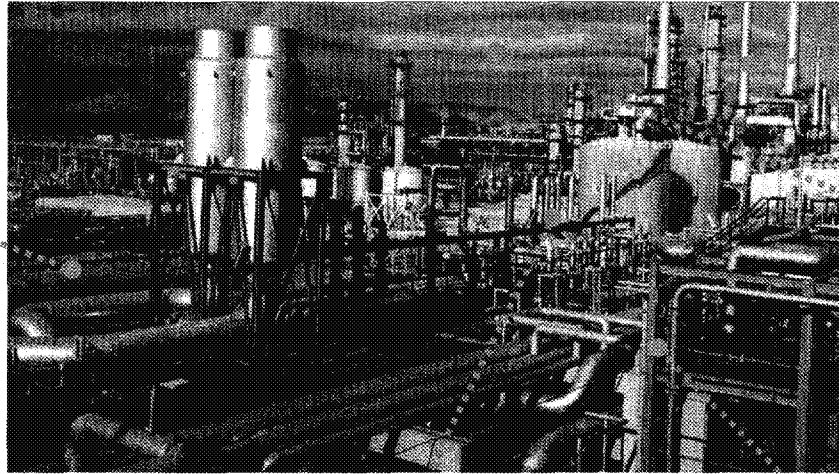
Utilizing a fabric filter as a reaction chamber creates a more efficient system for sorbent usage.



Emissions, Measurement, and Monitoring

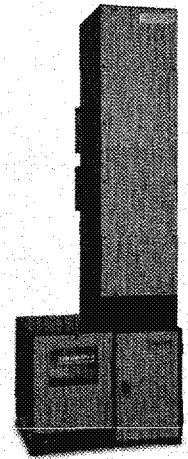


Leak Detection

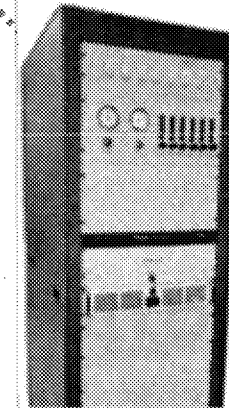


Continuous Emissions Monitoring Systems

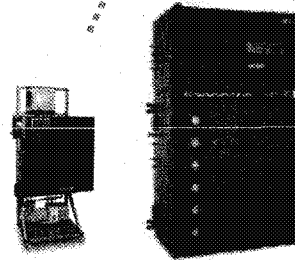
Source & Ambient Gas Analyzers



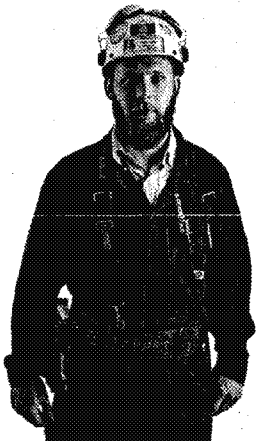
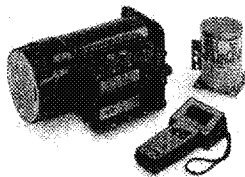
Ambient Particulate Monitors

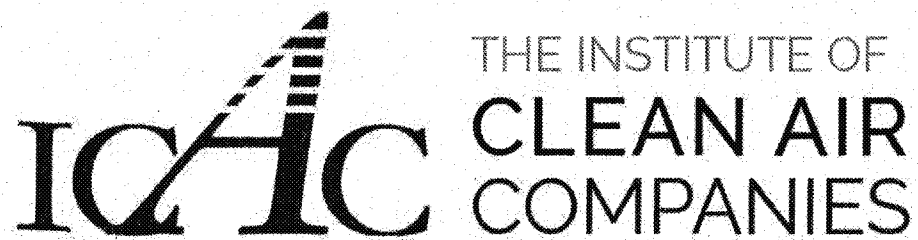


Process Gas Analyzers



Personal Monitors



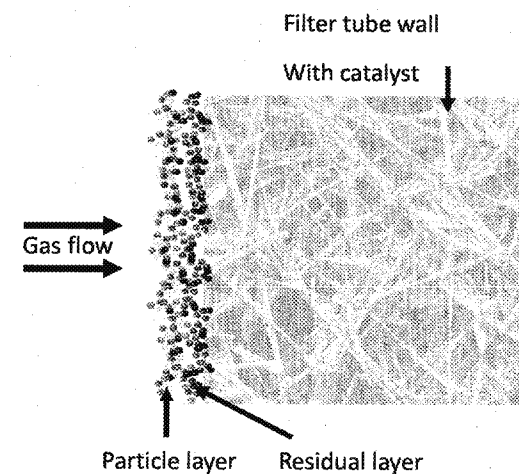
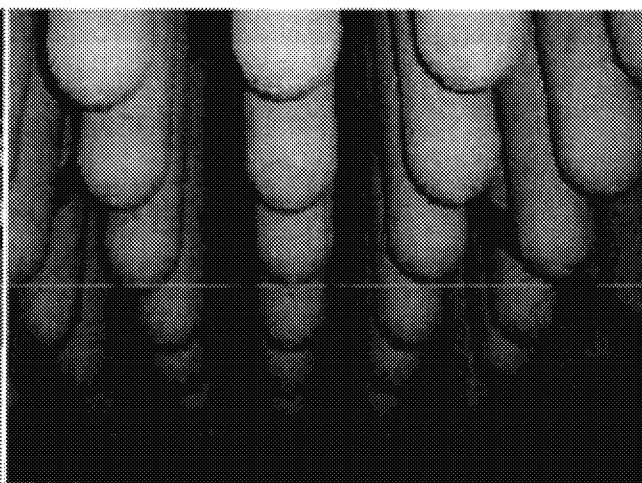
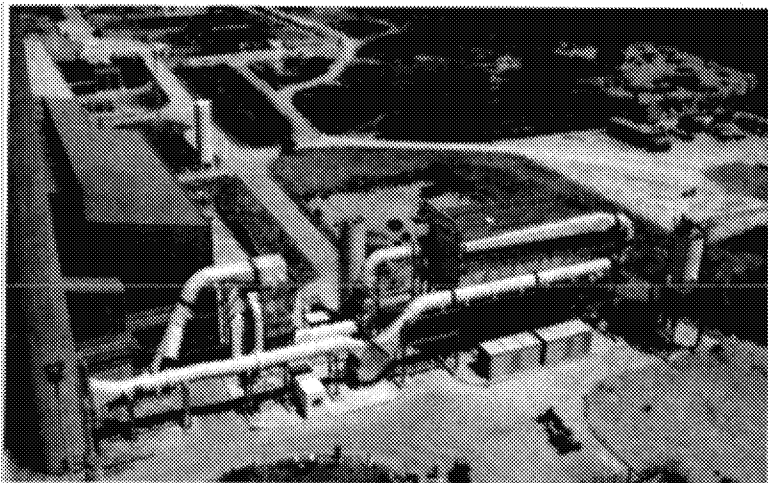
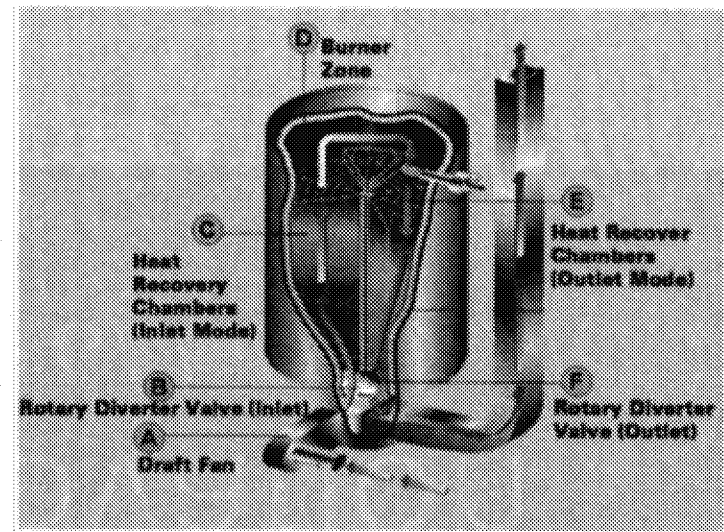


Continuous Innovation

Cost-Effective Technologies to Meet Global Demand

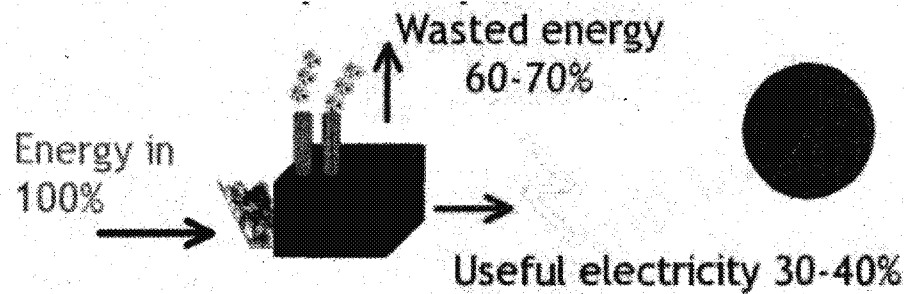
Continuous Innovation

- Improved efficiencies
- Innovative materials
- Significant OPEX and CAPEX reductions

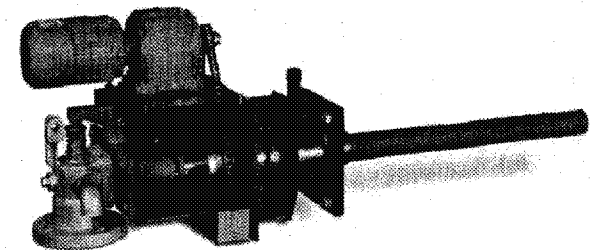
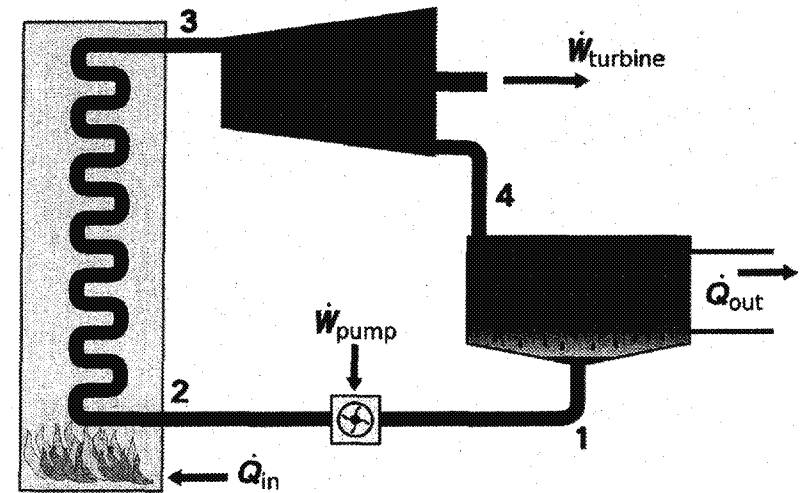
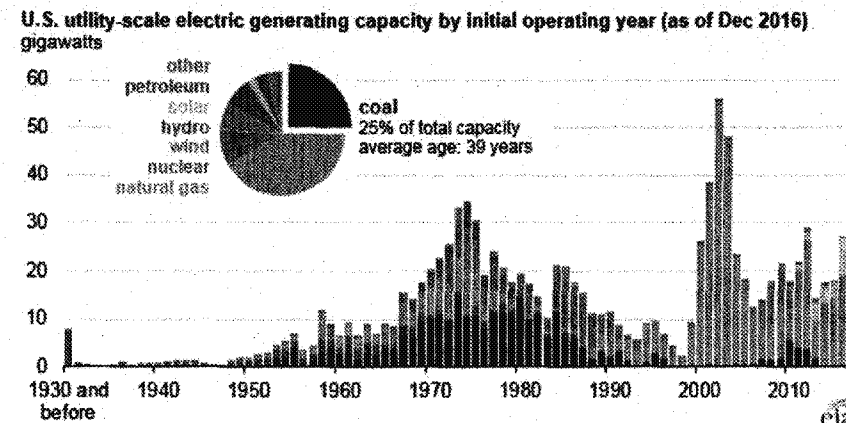


IMPROVING POWER PLANT EFFICIENCY

to Reduce Emissions of All Kinds

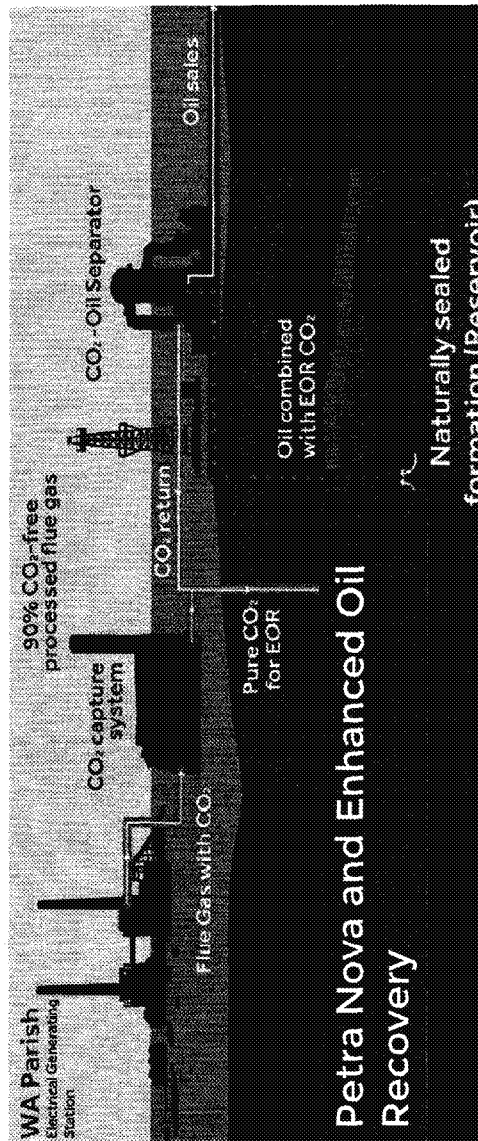


Most coal plants in the United States were built before 1990



Rotating Soot Blower

Commercial-Scale Clean Coal & Enhanced Oil Recovery Projects



World's Largest Coalmine-Mouth
Methane Capture Project



Investor confidence requires
commercially viable technologies and
stable investment environments



Concluding Thoughts



Ready To Be An Indispensable Resource To The EPA & Industry

Technology Has No Agenda. ICAC Members Make It Happen.

The ICAC has a **proud history** of accomplishment
since before the **Clean Air Act** first became law.

Air pollution control technologies
enable continuous progress toward:

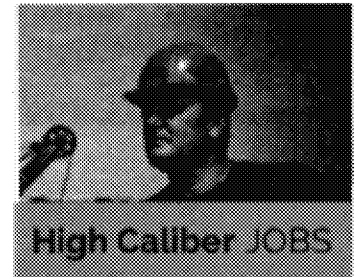
Lower COSTS

Healthier AIR

Higher EFFICIENCY

Greater Certainty for COMPLIANCE

These technologies have created high caliber
jobs and promoted economic growth.



ICAC members **continuously invest** in technology,
and stand ready to **meet new challenges.**

EPA can help further the progress industry has made by providing certainty, a
requisite for long-term investment in global leading technologies.

A Presentation by

The Institute of Clean Air Companies



www.icac.com

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